Meeting on Issues Relating to the California Phase 3 Reformulated Gasoline Regulations

August 18, 2000

California Environmental Protection Agency

Air Resources Board

Agenda

- Introduction
- Overview of issues and progress
- Presentation from others
- Schedule next meeting

Issues

- CaRBOB regulation
  - Tank Transition Effects
- Small refiners
- Denatured ethanol specifications
- Commingling
- Permeation
- Predictive Model and EMFAC2000
- Oxygenate waiver status
- Driveability index
- Sulfur in gasoline

CARBOB

- Amendments to CaRFG regulations to assure the practical blending of ethanol downstream of refininery and to facilitate the importation of gasoline.
- CaRBOB model for certification of ethanol blends prior to the addition of ethanol
- Storage tanks transition
- Proposal to the Board by October 2000

Tank Transitions Between CARBOBs and Non-Oxygenated CARFG

Small Refiners

- Amendments to the ARB's diesel fuel regulations to incorporate a mechanism for small refiners to fully mitigate any increased emissions associated with CaRFG3 small refiner previsions
- Proposal to the Board by October 2000

Proposed Specifications for Denatured Ethanol and Denaturants

	Specifications for Denatured Ethanol	Specifications for Denaturants
Sulfur, ppm	10 - 15 (?)	--
Benzene, vol.%	0.05	1.1%
Olefin, vol.%	0.50	10%
Aromatics, vol.%	1.7	35%

Denatured Ethanol Specifications

- **Sulfur Limit would be enforced by testing the denatured ethanol.**
- **The limits for benzene, olefins, and aromatics contents of denaturant are limited to the CaRFG3 Cap limits.**
- **Benzene, olefins, and aromatics limits would be enforced by determining the concentrations of these compounds in the denaturant and calculating the concentrations corresponding to the amount of denaturant added.**
- **Requires product transfer documents with description of ethanol and denaturant.**

Sulfur Levels in Denatured Ethanol for Different Addition Levels of Denaturant

Undenatured Ethanol	Denatured Ethanol[1]	
	2.0% Denaturant[2]	4.8% Denaturant[2]
8	9	10
9	10	11
10	11	12
11	12	13
12	13	14
13	14	15

1 Assumes that the denaturant has a sulfur level of 60 ppm.

2 Federal regulations and ASTM standards require a minimum denaturant concentration of 2% and limits the maximum concentration at 4.8%.

Commingling Effects

- Investigate effects from commingling EtOH blends and non-oxygenated gasoline
- Recommendations to Board by December 2001

Permeation Emissions

- Contract in place with Harold Haskew & Associates
- Update the Board in October 2000 on the potential increase in hydrocarbon emissions from material permeability with the use of ethanol in gasoline
- Report to the Board on the results of permeability testing by December 2001

Predictive Model and EMFAC 200

- EMFAC 2000 inventories approved (pending resolution of a couple of outstanding issues) by the ARB in May 2000
  - Resolution of the outstanding issues were not be in time to meet the deadline for the adoption of the CaRFG3 Regulations

Oxygen Waiver

- Continue to pursue the U. S. EPA oxygen waiver
  - Continue to support request to U. S. EPA to waive the application of the federal RFG year-round 2.0 wt.% minimum oxygen requirement for federal RFG areas

Driveability Index

- Transmitted to the U. S. EPA the board's recommendation to adopt a nationwide DI standard to assure the adequate emissions performance of existing and advanced technology motor vehicles
- To evaluate driveability characteristics of in-use CaRFG3 to determine if adequate
- Report to the Board by 2004

Sulfur Content

- Evaluate CaRFG3 sulfur levels
- Complete evaluation with CEC on impacts of near zero sulfur levels in gasoline (including impacts on supply and cost of production)
- To be completed in 2004

Other Issues

- Work with local air quality management districts and local communities to address potential impacts from an increase use of cargo tank trucks to transport ethanol
- Provide the Board with update every 6 months on the of the implementation of the directives

Other Meeting Items

- Presentation from others
- Schedule next meeting

TERMINAL TANK TRANSITIONS

Terminal Tank Transitions

- 0-OXY CaRFG to CaRBOB
- CaRBOB to 0-OXY CaRFG
- CaRBOB “A” to CaRBOB “B”

Properties of Fuels and CaRBOBs

- Fuels used in the ARB's waiver request dated Dec. 24, 1999.
  - (0, 2, 2.7, and 3.5 wt.% oxygen)
- Lower sulfur fuels derived from the MathPro December 7, 1999 analysis
  - (2 and 2.7 wt.% oxygen)
- Use WSPA CaRBOB model (7/20/00 version) to obtain a CaRBOB for each fuel
- Use linear model to calculate properties of transition CaRBOBs or non-oxy fuels

Tank Transition Procedure

Assumptions

- Heel levels before transition:
  - terminal tank reduced to 10%, 25%, or 50% of capacity
- At each tank turnover, terminal tank is filled to capacity with the target CaRBOB or fuel
- The transition CaRBOB from each tank turnover is blended with ethanol at the level of the target fuel

Compliance of Transition Fuel

- Predictive model standards.
  - (hydrocarbons, NOx, and toxics)
- RVP
- Octane not considered

Example Calculation of Properties of a Transition CARBOB

	CARBOB (5.7)	CARBOB (7.7)	Transition* CARBOB
Aromatic HC, vol%	26.5	27.0	27.0
Benzene, vol%	0.80	0.75	0.76
Olefins, vol%	6.3	4.3	4.5
Sulfur, ppm	20	14	14.6
T50, deg F	217	213	213
T90, deg F	307	313	312
Oxygen, wt.%	0	0	0
RVP, psi	5.6	6.0	5.9

* 10 % CARBOB 5.7 (heel) + 90% CARBOB 7.7 (target CaRBOB)

Number of Tank Turnovers Not Meeting Predictive Model Standards

Ethanol Content (vol%)	Heel Amount	10%	25%	50%
	CaRFG to CaRBOB			
	0 to 5.7	1 (THC)	1 (THC)	3 (THC)
	0 to 7.7	1 (THC)	1 (THC)	3 (THC)
	0 to 10	1 (NOx)	1 (NOx, THC)	3 (THC, NOx)
	CaRBOB to CaRBOB			
	5.7 to 7.7 (20 & 14 ppm sulfur)	1 (NOx)	1 (NOx)	3 (NOx)
	5.7 to 7.7 (14 & 12 ppm sulfur)	0	0	1 (NOx)
	5.7 to 10	1 (NOx)	2 (NOx)	>3 (NOx)
	7.7 to 10	1 (NOx)	2 (NOx)	>3 (NOx)
	7.7 to 5.7	0	0	1 (THC)
	10 to 5.7	0	1 (THC)	3 (THC)
	10 to 7.7	0	0	1 (THC)
	Any CaRBOB to Non-oxy CaRFG	No emissions increase on any tank turnover		

Note: Assumes tank filled to capacity for each tank turnover.